RX — W (red male)
WX — WX (white female)

RWXX (50 %) — WWX (50 %)

The converse cross between a white-eyed male RWX and a wild, red-eyed female shows that the wild female is homozygous both for X and for red eyes. Thus:

WX — W (white male)
RX — RX (red female)

RWXX (50 %) — RWX (50 %)

The results give, in fact, only red males and females in equal numbers.

General Conclusions

The most important consideration from these results is that in every point they furnish the converse evidence from that given by Abraxas as worked out by Punnett and Raynor. The two cases supplement each other in every way, and it is significant to note in this connection that in nature only females of the sport *Abraxas lacticolor* occur, while in *Drosophila* I have obtained only the male sport. Significant, too, is the fact that analysis of the result shows that the wild female *Abraxas grossulariata* is heterozygous for color and sex, while in *Drosophila* it is the male that is heterozygous for these two characters.

Since the wild males (RWX) are heterozygous for red eyes, and the female (RXRX) homozygous, it seems probable that the sport arose from a change in a single egg of such a sort that instead of being RX (after reduction) the red factor dropped out, so that RX became WX or simply OX. If this view is correct it follows that the mutation took place in the egg of a female from which a male was produced by combination with the sperm carrying no X, no R (or W in our formulæ). In other words, if the formula for the eggs of the normal female is RX—RX, then the formula for the particular egg that sported will be WX; *i. e.*, one R dropped out of the egg leaving it WX (or no R and one X), which may be written OX. This egg we assume was fertilized by a male-producing sperm. The formula for the two classes of spermatozoa is RX—O. The latter, O, is the male-producing sperm, which combining with the egg OX (see above) gives OOX (or WWX), which is the formula for the white-eyed male mutant.

The transfer of the new character (white eyes) to the female (by crossing a white-eyed male, OOX to a heterozygous female (F_1)) can therefore be expressed as follows:

OX — O (white male)
RX — OX (F_1 female)

RXOX—	RXO —	OOXX—	OOX
Red female	Red male	White female	White male

It now becomes evident why we found it necessary to assume a coupling of R and X in one of the spermatozoa of the red-eyed F_1 hybrid (RXO). The fact is that this R and X are combined, and have never existed apart.

It has been assumed that the white-eyed mutant arose by a male-producing sperm (O) fertilizing an egg (OX) that had mutated. It may be asked what would have been the result if a female-producing sperm (RX) had fertilized this egg (OX)? Evidently a heterozygous female RXOX would arise, which, fertilized later by any normal male (RX—O) would produce in the next generation pure red females RRXX, red heterozygous females RXOX, red males RXO, and white males OOX (25 per cent.). As yet I have found no evidence that white-eyed sports occur in such numbers. Selective fertilization may be involved in the answer to this question.

T. H. Morgan

Woods Hole, Mass.,
July 7, 1910

ELECTROLYTIC EXPERIMENTS SHOWING INCREASE IN PERMEABILITY OF THE EGG TO IONS AT THE BEGINNING OF DEVELOPMENT

It has been shown that at the beginning of development of the egg there is an increase in the absorption of oxygen (Warburg) and excretion of carbon dioxide (Lyon). This is evidently accompanied by increased oxidation within the egg, but varying views as to the cause of the increase have been advanced. The more rapid oxidation might be due to the

presence of oxidases within the egg or to an increase in the permeability of the egg to oxygen or carbon dioxide. The carbon dioxide might diffuse as ions or undissociated molecules, the oxygen only in the latter form. The lipoids of which the protoplasm is largely composed are relatively impermeable to ions.

With a view toward a decision between the above-mentioned views I studied the permeability of the egg of *Lytechinus* (*Toxopneustes*) *variegatus* to ions, at the Carnegie Laboratory at Tortugas, Fla. Since the ions alone carry the electric current through a solution, it was thought sufficient to measure the electric conductivity of the eggs (by the method of Kohlrausch).

The conductivity of the eggs was found to be very much lower than that of the sea water, and to be increased on fertilization or beginning of parthenogenesis. For example, in one experiment, the resistance (the reciprocal of the conductivity) of the sea water was 53 ohms, that of the unfertilized eggs 595 ohms and that of the same eggs after fertilization 455 ohms. In another experiment the resistance of the unfertilized eggs was 519 ohms and that of the same eggs made parthenogenetic with acetic acid 485 ohms.

During each set of experiments, the temperature (which was not far from that of the sea) did not vary one tenth of one degree. The amount of sea water mixed with the eggs was kept constant by removing all of the jelly-like coverings, centrifuging the eggs in the conductivity vessel, marking their upper level with a fine pen and indelible ink and centrifuging them down to the same level before every reading. The conductivity of the sperm and of the acetic acid solution was slightly less than sea water and each was thoroughly washed out with sea water. If the eggs, after having pushed out "fertilization" membranes, were centrifuged down to the former level, some of them were distorted, but this possible source of error was controlled by using eggs that had been washed so long in sea water that membranes were not pushed out in normal nor in parthenogenetic development. The current passed through the eggs was not sufficient to stimulate nerve.

The increased production of carbon dioxide was not sufficient to account for the increased conductivity, for the conductivity of the sea water was not measurably increased by saturating it with carbon dioxide.

The conductivity of the egg is much lower than that of an aqueous solution of its ash made up to the same volume. This may be due to the resistance of the surface layer, but is partly due to internal conditions as shown by placing the electrodes within the egg (hen's egg yolk). Experiments which I made at Cornell Medical College indicate that this low internal conductivity of the egg is due to the presence of poorly dissociated ion-proteid compounds (or adsorpates). The "yellow" yolk of the hen's egg consists of two non-miscible fluids and fine granules. The two fluids are both solutions containing lipoid-protein compounds and are not of sufficient difference in specific gravity to allow separation by the centrifuge. The granules are probably lecith-albumins and are precipitated by the centrifuge.

Hen's egg yolk was centrifuged and the top layer, containing very few granules, separated from the bottom layer, containing numerous granules. The following figures represent the elective conductivity (when divided by 100,000):

Layer	Undiluted	+ 1 vol. H_2O	+ 2 vols. H_2O	+ 3 vols. H_2O
Upper	302	268	162	96
Lower	278	278	200	125

The conductivity of the upper layer decreases with dilution, but a dilution of the lower layer with one volume of water does not decrease its conductivity. If this failure of dilution to decrease the conductivity were wholly due to the increase in the spaces between the granules (the fluid conducting and the granules insulating) the conductivity of the upper layer diluted with one volume of water would be greater than that of the lower layer at the same dilution, but the reverse being the case shows that the dilution must have caused the liberation of electrolytes from the granules.

The increase in electric conductivity of the egg at the beginning of development may be due to increased permeability to ions or to the liberation of ions from (physical or chemical) combination with proteids, but it is improbable that the latter occurs to any great extent, as no dilution of the egg contents (swelling of the egg) takes place.

We may conclude, then, that, at the beginning of development, the egg becomes more permeable to ions and thus the dissociated carbon dioxide is liberated. This decrease in an end product of oxidation in the egg allows an acceleration of oxidation and the consumption of oxygen. The decrease in oxygen leads to its increased absorption.

J. F. McClendon

Boca Grande Key, Fla.,
June 30, 1910

GEOLOGY AND GEOGRAPHY AT THE BOSTON-CAMBRIDGE MEETING

In accordance with the custom of the past few years, the officers of Section E did not ask for titles of any papers to be read at the Boston-Cambridge meeting, for the reason that the Geological Society of America, the Paleontological Society and the Association of American Geographers held meetings for the reading of papers. The meetings of these special societies occupied all the time from Tuesday morning, December 28, to Saturday night, January 1.

There were twelve titles of papers presented to Section E. These papers were read on Monday, December 27, in the University Museum, Cambridge, and were listened to by some fifty to seventy-five geologists and geographers. Between the morning and afternoon sessions many of those present enjoyed lunch at special tables in Memorial Hall.

SECTION E

The following officers for the Boston-Cambridge meeting were elected: member of council, Professor A. P. Brigham, and member of general committee, Dr. G. Otis Smith. The sectional offices were filled by the election of Dr. John M. Clarke, state geologist, Albany, N. Y., as vice-president for the ensuing year, and Dr. C. Willard Hayes, chief geologist of the U. S. Geological Survey, to serve as member of the sectional committee for five years. In accordance with a change in the constitution adopted at this meeting, the following become members *ex officio* of the sectional committee: Arnold Hague, president of the Geological Society of America; Dr. E. O. Hovey, secretary of the Geological Society of America; Professor H. C. Cowles, president of the Association of American Geographers, and Professor A. P. Brigham, secretary of the Association of American Geographers.

As retiring president of the Paleontological Society, Dr. John M. Clarke found it necessary to decline the honor of his selection as vice-president of Section E. The sectional committee of Section E have therefore nominated Professor Christopher W. Hall, professor of geology at the University of Minnesota, Minneapolis, to be the next vice-president.

The sectional committee of Section E is constituted as follows: retiring vice-president, Reginald W. Brock; vice-president, Christopher W. Hall; secretary, F. P. Gulliver; preceding secretary, E. O. Hovey; for one year, E. H. Barbour; for two years, J. B. Woodworth; for three years, F. B. Taylor; for four years, G. K. Gilbert; for five years, C. W. Hayes; president Geological Society of America, Arnold Hague; secretary Geological Society of America, E. O. Hovey; president Association of American Geographers, H. C. Cowles; secretary Association of American Geographers, A. P. Brigham.

VICE-PRESIDENTIAL ADDRESS

The retiring vice-presidential address of Mr. Bailey Willis on "Principles of Paleogeography" was given on Tuesday evening in the Geological Lecture Hall of the Massachusetts Institute of Technology at eight o'clock. This was published in Science, N. S., Vol. XXXI., p. 241.

HARVARD COLLEGE OBSERVATORY

Professor E. C. Pickering invited the geologists and geographers present at the meeting to visit the Harvard College Observatory in Cambridge on Monday afternoon from three to six. Professor E. C. Pickering and Professor W. H. Pickering met parties of geologists and geographers, numbering from ten to twenty, and turned them over to the various members of the scientific staff of the observatory. All portions of the observatory were open to inspection, and while some of the visitors spent most of their time in the study of the astronomical photographs, others were more interested in the study of variable stars, while still others cared more to see the methods of